



# Creating an industry-level business model for sustainability: The case of the European ports industry

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## ABSTRACT

The seaports industry is an industry that produces voluminous negative externalities on the local and regional level, and is also affected by the challenges of climate change. To improve the dimensions of the sustainability – economic, social or ecological dimensions for cleaner production – on an industry level, there is a need to build an inter-organizational network. In this paper, we apply a virtual learning model for the setup of an interorganizational network (ION) for sustainable development in the ports industry, which offers a unique context of high stakeholder complexity and conflict. The value of this paper is that it builds on previous research on the role of the net broker function for triple bottom line transitions through an action research project for the creation of an ION for sustainable development. We furthermore provide managerial recommendations for the setup of such networks.

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## 1. Introduction

Seaports are large networked infrastructures with considerable and environmental impacts such as noise disturbance, air pollution and visual impediments (Acciaro, 2015). Climate change consequences, for example sea level rise, high winds, and storm surges can have considerable impacts on ports' facilities as well, which could endanger a region's import and/or export (Hanson and Nicholls, 2012; Asariotis and Benamara, 2012; Becker et al., 2013; Ng et al., 2016). Similar to other large industrial operations generating substantial externalities, transport industries are large polluters (Bergqvist and Egels-Zandén, 2012). Following the Paris Agreement, which came into effect November 4th, 2016, ports are increasingly looking at how to tackle issues related to climate change (ESPO, 2017; PIANC, 2017). Stakeholders such as environmental pressure groups or local and regional governments, but also supply chain actors are increasingly transferring the pressure from their end customers to the various nodes of the supply chain. Ports are facing up to the environmental challenge and seek to demonstrate their environmental responsibilities as well as running a safe and successful commercial operation (Wooldridge et al., 1999).

Ports, and their managing bodies, can create and support regulatory measures to transport operators (e.g., shipping lines) in their effort to improve the industry's sustainability (IAPH, 2008; European Commission, 2013), given their position in the supply chain as infrastructure nodes embedded in a complex trade and logistics network (Ng and Liu, 2014; Ng et al., 2016). Ng et al. (2016) highlight several reasons as to why climate adaptation planning among ports has not been effective yet. One of the reasons being the fact that information and knowledge is scattered throughout the stakeholder landscape. Steurer (2010) argues that governance models for sustainability are formed, driven by the evolution of governments being no longer the sole actor in charge of steering the community. Manring and Moore (2006), Manring (2007) and Lozano (2008), claim that there is a need for a new, proactive paradigm, wherein collaboration commences and is intensified through the involvement of a net broker in an interorganizational network (ION) between several stakeholders to construct significant and effective practices that can diminish the negative impacts from climate change as a global issue. In general, it has been suggested that businesses, governments and societies are increasingly becoming stuck in paradigms, preventing reconfigurations, or making it very difficult to shift towards a more sustainable paradigm (either economic, social or environmental shifts) (Manring, 2014). Given the complexity in terms of institutional and administrative challenges in the light of sustainable industrial development, Hawken (1993) confirms there is an ongoing need for

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conceptual models that allow understanding better the various forms of interorganizational collaborative partnerships among stakeholders.

In this paper, we observe the transition towards an interorganizational network (ION) for sustainability. In the European ports industry, if we consider the central role of the port authorities as appropriate for the set up of such an ION, we investigate what should be done to kick off this process. The specific characteristics of the sector warrant the need for a specific approach. Through the case of a four-year research project which focuses on transitioning the European ports industry to advances in sustainable development we focus on the specific aspect of the role of the net broker function. The case context is particularly interesting, given the presence of a variety of stakeholders, such as for-profit organizations (terminal operators, shipping lines), hybrid organizations (port authorities), governments and trade associations (van der Lugt et al., 2013) whom also have a culture of distrust vis-à-vis each other (Langenus and Doms, 2015). This situation is quite particular and extreme, so exploring this case is worthwhile as it can provide additional managerial and policy implications to overcome distrust between stakeholders in complex and contested industries (Yin, 2000). We build on Manring and Moore's (2006) framework, which focusses on the different field and background of the North Carolina wet textile processing industry, and apply it to the fundamentally different case of the European ports industry. We find that our application, based on action research, offers interesting new insights to the concept of the net broker in framework of Manring and Moore (2006).

In the second section, we review literature regarding the creation and management of a sustainability network. The third section briefly stipulates the current state of the European ports industry regarding efforts to sustainable development. The subsequent section contains the methodology, hereafter we present our case. Results and discussion sections precede the conclusions, which contains also limitations and suggestions for future research.

## 2. Theoretical background

### 2.1. Creation and management of a network for sustainability

Manring and Moore (2006) have described the dimensions that came forward in the creation and management of an ION for sustainability in their case of the North Carolina textile wet processing industry. They specify that for an ION to move to a sustainable development network, the network should contain specific dimensions, operate as a 'Virtual Web', have a net broker and incorporate processes that allows the ION to function as a learning organization. In this section, we elaborate on their framework with specific focus on the aspect of the net broker.

#### 2.1.1. Moving from an inter-organizational network to a sustainable development network

There are five key dimensions of interorganizational networks (IONs) that promote sustainable development as described in Manring and Moore's framework (2006):

1. *Unifying purpose*: There should be a consensus amongst the various stakeholders towards the value of the interorganizational network (ION). Through the development of the value propositions per stakeholder ("building different bridges" as described by Frow et al., 2014) the resource integration process inherent to collaboration has become more attractive for each stakeholder. The value propositions are based on the resources of that individual member-organization, and will move other

organizations to become a member of the network (Manring, 2007; Frow et al., 2014). Through collaboration based on consensus, a shared value should emerge that moves the individual members towards a unifying purpose beyond the organization's individual goals. This thought is in line with the demanded paradigm change, as proposed by Lozano (2008) and Hawken (1993).

2. *Independent members*: Every stakeholder organization linked to the network can operate on its own, but also has the advantages of the membership in the network.
3. *Voluntary links among independent yet interdependent members*: Manring and Moore (2006) posit that the links in networks for sustainability are more "profuse and omni-directional" than in other types of organizations. Links can strengthen through better communication.
4. *Multiple leaders*: The network specifically has the characteristic of multiple leaders, i.e. members than can add something unique to the network. As each actor possesses unique resources, a unique value proposition arises to which other actors are drawn to, inclining them to collaborate. A value proposition is defined by Frow et al. (2014) as a "dynamic and adjusting mechanism for negotiation how resources are shared within a service ecosystem".
5. *Integrated levels*: Because the network is comprised of small groups and coalitions, the links between the stakeholders are vital for data flow. These links are more difficult to forge when the diverse stakeholders are unaware of each other's concerns and characteristics, or if there is no (or not enough) trust between them. The network should work as a "Virtual Web", as if the stakeholders were users, which connect to the World Wide Web, and who trust the connection will be made to share information. Literature on trust in collaborations has also identified trust as a key element to ensure a successful partnership in networks (e.g., amongst others, Blumberg et al., 2012). Trust can be defined as "the willingness of a party to be vulnerable to the actions of another party based on the expectation that the other will perform a particular action important to the trustor, irrespective of the ability to monitor or control that other party" (Mayer et al., 1995).

#### 2.1.2. Sustainable development network operating as a Virtual Web

It is difficult to develop solutions with regards to sustainability concerns given the complexity of the matter on industrial development level (Manring and Moore, 2006). "Virtualness" (Venkatraman and Henderson, 1996) is defined as the ability of a network to involve multiple stakeholders in value adding shared learning processes, in order to create integrated solutions to complex sustainable industrial development issues (Manring and Moore, 2006). Value added shared learning is done through the processes of: (i) "multiplexing", and (ii) "virtual memory". The former concept describes the parallel transmission of multiple messages over a single line. This is the core of integrating multiple stakeholders' views into the communication of an organization. Translated to the network level, specific value can be created through multiplexing communication and a plan for data storage and external communication: the communication infrastructure is not owned by a single node, but rather by all nodes (Senge, 1990; Manring and Moore, 2006). The latter concept is applied to the context, the ability to operate a larger sustainable development program than a single stakeholder could run, because of information exchange.

The aspect of trust is also vital for the network. Manring and Moore (2006), and Manring (2007), identify the "Spiral of Trust" (Franke, 1999) in their cases: links created between the

stakeholders grow, develop or dissolve and communication is strengthened, leading to improved trust between the stakeholders.

### 2.1.3. The need for a net broker in a sustainable development network

A “net broker” manages the network and serves the functions of facilitator, coordinator and moderator among the stakeholders of a collaborative network. We will now consider the 5 duties of the net broker, as firstly described by Franke (1999) and secondly used by Manring and Moore (2006) with relation to their industry case study:

1. *Initiation and preparation of the network:* In the textile case of Manring and Moore a separate consultant was hired to create a common bond, install mutual trust, and act as a ‘trust bridge’, i.e. stakeholders did not trust each other directly, but did trust the consultant.
2. *Maintaining and improving network collaboration:* the net broker enabled processes such as negotiations of problem definitions and standardized practices, or, partnering among network members. Also, in the textile case of Manring and Moore (2006) they highlighted that the consultant provided supervision for the project design, implementation, stakeholder meetings and progress reports.
3. *Promoting the partnership concept:* Also referred to as the “caretaker” function (Snow et al., 1992).
4. *Monitoring and continuously improving network performance:* if collaboration for sustainability is installed, it is also vital to monitor the performance dimensions inherent to sustainability, i.e. economic, social and environmental.
5. *Responding to opportunities:* the net broker identifies opportunities for members of the network (Snow et al., 1992). To do so, the net broker can create what Franke (1999) calls a “virtual value chain”: based on the knowledge of the resources and competencies that stakeholders possess, the net broker can coordinate and integrate these in the response to opportunities. As each actor possesses resources but also seeks to fill resource gaps in response to value propositions (of other members), which arise from the value potential in their resources (Hilton et al., 2012). Attracting a range of diverse stakeholders and their respective resources could assist in the survival of the service ecosystem (Cardinale et al., 2006). Note that in the management literature the terms ecosystem and network are used interchangeably (Battistella et al., 2012; Chesbrough, 2007; Kudina et al., 2008; Yiu and Yau, 2006; Frow et al., 2014). Resource integration can lead to the transformation towards a “value creation system (Normann, 2001; Frow et al., 2014). Once the textile industry became more of an “intentional learning community”, a new culture of studies, measurements and improvements were installed to ensure the necessary changes. Such movement becomes more clear if the interorganizational network is observed as a virtual learning organization (Manring and Moore, 2006).

### 2.1.4. Sustainable development network as a virtual learning organization

Partnerships that wish to address sustainability problems, need to consciously become a learning organization that incorporates systems thinking, collaborative learning and consensus-based decision making in order to deal with complexity (Manring and Moore, 2006). A sustainable development network provides the multiplicity of perspectives necessary for generative learning that revolves around creating solutions for a diversity of stakeholders. In a more recent paper, Manring (2007) also utilizes the concept of the

“ecosystem management network”, which she defines as a “strategic alliance among stakeholders who come together to improve sustainable resource management of a complex system”. Sustainable ecosystem management has been claimed to become of vital concern for two reasons: (i) Ecosystems are inextricably linked with one another, but the diverging stakeholders’ interests can lead to conflicts, and (ii) the increasing need for collaboration in order to be able to provide quality standards whilst respecting the natural environment (Manring, 2007).

Manring and Moore (2006) have applied 5 essential disciplines, as defined by Senge (1990) on an industry level interorganizational network:

1. *Building a shared vision – the practice of unearthing shared pictures of the future that foster genuine commitment:* Working towards a shared vision beyond the network members’ individual boundaries. It is key that the shared vision supports the systemic, sustainable perspective (Fulmer and Keys, 1998). The research Frow et al. (2014) adds to this characteristic, taking an ecosystem perspective for industry contexts, the authors identify that actors within an ecosystem will engage in resource integration if there is a value proposition for each actor. Thus, combining the findings of Manring and Moore (2006) with the research of Frow et al. (2014), it is key that if an ION on industry-level is working towards sustainability solutions, each partner will need a value proposition to engage in the collaboration, whilst concomitantly creating an overall shared value for the network that can lead the network to a new culture of long-lasting (green) performance management. A net broker’s function is then to integrate resources of the network members, filling resource gaps in response to value propositions (Frow et al., 2014; McColl-Kennedy et al., 2012).
2. *Personal mastery – becoming increasingly self-aware and honing the skill of continually clarifying and deepening one’s personal vision:* the individuals (which can be either persons or organizational members) had to adjust their vision considering the shared vision of the network to be able to create systemic solutions.
3. *Surfacing and testing mental models – the ability to unearth one’s internal pictures of the world, to scrutinize them, and to make them open to the influence of others;* the willingness to discard old ways of thinking and standard problem-solving routines: the network formed for the textile industry became more focused on continuously improving the US textile industry with regards to sustainability related performance, versus only developing one solution for a specific problem. Thus, the network became a true sustainable development network.
4. *Team-learning – the capacity to think together which is gained by mastering the practice of dialogue and discussion:* sustainable development became over time more so viewed in the sense of the whole (less in terms of the individual organization’s goals). The term “holographic thinking” (Senge, 1990) describes how a small separate piece of a holograph (member of a network) still represents the image fully, but that two different pieces represent the image from a different point of view.
5. *Systems thinking – the discipline that integrates other perspectives, fusing them into a coherent body of knowledge:* If you were to add up the different pieces from a holograph, the image becomes more lifelike. Thus, when different stakeholders come together to share the vision of becoming more sustainable, they can envisage the goal better. Thus, creating consensus for systemic solutions will become more easily attainable without counterarguments from an individual organization that would put a certain individual value to the front (e.g. commercial

sensitivity). This also relates to the insights from work by Frow et al. (2014) as seen in the first discipline.

## 2.2. Sustainability in European ports industry

Seaports, being large networked infrastructures, produce negative externalities, e.g. noise disturbance, air pollution and visual impediments (Bergqvist and Egels-Zandén, 2012; Acciaro, 2015). But on the other hand, consequences due to climate change (sea level rise, high winds, storms) have significant impacts on ports' facilities as well (Hanson and Nicholls, 2012; Asariotis and Benamara, 2012; Becker et al., 2013; Ng et al., 2016). Following the Paris Agreement, ports are exploring to how improve their environmental performance (ESPO, 2017; PIANC, 2017). Stakeholders with environmental claims in the ports industry consist of environmental pressure groups or local and regional governments, as well as supply chain actors whom are increasingly transferring the pressure from their end customers to the various nodes of the supply chain (Darbra et al., 2005; ESPO, 2012). Ports are facing up to the environmental challenge and seek to demonstrate their environmental responsibilities as well as running a safe and successful commercial operation (Wooldridge et al., 1999). Port authorities act as cluster managers whose task it is to manage the negative externalities produced within the port area boundaries, using various tools, such as, for example, concession policy, investment policy, etc.

Ports are in a unique embedded position in the supply chain, which enables them to provide incentives to industry stakeholders in their effort to improve the industry's sustainability (IAPH, 2008; European Commission, 2013). Ports are not stand-alone fortresses separated from the rest of the globe, but are nodes entrenched in a complex trade and logistics network, consisting of shippers, shipping lines, terminal operators, etc. (Ng and Liu, 2014; Ng et al., 2016).

Thus, as the customers increasingly stress the value of sustainable and green supply chains, initiatives that strengthen to the ports' sustainability will benefit the port authority (Robinson, 2002; Acciaro, 2015). Port authorities are aware that environmental and social performance is key to the relation with the local community where the port is embedded in, as it strengthens the 'license to operate and to grow' and can become a source of competitive advantage as well (Adams et al., 2009; Wiegman and Geerlings, 2010). Certain port authorities produce a separate sustainability report (e.g. Port of Antwerp's awarded sustainability report) or incorporate sustainability into their annual report (e.g. Port of Rotterdam). Acciaro (2015) states that corporate responsibility can improve the competitiveness of a port as it, amongst other reasons, allows for better stakeholder management, and can influence regulation that is focused in the reduction of negative environmental and/or social impacts. The ability to adapt swiftly to new regulations and new customer demands will be key for the sustainability of a port (Acciaro, 2015). Therefore, it is crucial that the internal and external environment of ports are mapped, monitored and linked in a scientifically correct manner so that port authorities can adapt rapidly to change (Paixão and Marlow, 2003).

However, in the ports industry the necessary information to do so is scattered throughout the stakeholder landscape. Ng et al. (2016) highlight the explanations as to why climate adaptation development has not been effective yet in the ports industry: ports have 'inadequate information' and 'need to know more about the issue'. Furthermore, as Acciaro (2015) rightfully states, seaports are embedded in a 'local normative and social context, and at the same time need to maintain an international focus'.

### 2.2.1. Collaboration in the European ports industry to improve sustainability

Over the years, collaboration between port-related industry stakeholders has taken form, such as the EcoPorts initiative or the World Ports Climate Initiative with a unique focus on the environmental/ecological dimension. However, integrative efforts that incorporate the three sustainability dimensions (economic, social and environmental) in a collaborative initiative have been rare, or at least less apparent than in other large infrastructure industries.

The stakeholder landscape is complex in the port industry, encompassing both private and public entities and every hybrid form in between (Talley, 2009; Verhoeven, 2009), profit and not-for-profit orientations, geographical conditions, large and small organizations, etc. (Kolk and van der Veen, 2002). This variety of characteristics can potentially be a barrier for collaboration. Furthermore, the industry is characterized by diverse activities such as transport, logistics, large-scale manufacturing and other sectors. Climate change impacts will thus be different per type of port stakeholder (Martin and Thomas, 2001; Becker et al., 2013; Ng et al., 2016). Logically, the solutions the diverse stakeholders seek will be different as well.

The research project Ports Performance Indicators: Selection and Measurement (PPRISM) was a research project that began in 2009, originating from the 2007 European Commission 'Communication on ports policy' where there was a Call to 'lay the foundations of a European Ports Observatory' (CEU, 2007). The European Seaports Organization (ESPO), the industry trade association, sought as the project coordinator, together with 5 universities, the most relevant and feasible performance indicators to assess the performance of the European seaports industry in several dimensions, i.e. market trends and structure, socio-economic, environmental, logistics chain and operations and governance (PPRISM, 2011). In the end, 14 indicators were chosen through various industry stakeholder consultations and further developed and calculated. The project ended in 2011 and produced (i) the European Ports Performance Dashboard 2012 (a leaflet visualizing the status of the performance of the European seaport industry on 5 major dimensions); (ii) deliverables related to the goals of the project and (iii) MS Excel sheets for calculation of the sustainability indicators.

## 3. Methodology

Manring and Moore propose their framework based on the interorganizational network (ION) set up in the North Carolina textile wet processing industry and demonstrate that these cases can provide managerial knowledge on linking different stakeholders in triple bottom lines transitions and its related challenges. Their case concerns a low-conflict and low-complexity stakeholder landscape, wherein the initial attitude for sustainable development through collaboration was relatively positive. The mutual concern for improving triple bottom line performance, given the regulated topic, was shared by the members of the interorganizational network (ION).

Based on the case of the setup of an ION for sustainability in the EU ports industry, we analyze whether we find validation for the framework by Manring and Moore (2006), under an initial condition of high stakeholder complexity and conflict (Parola and Maugeri, 2013; Galvao et al., 2016), or whether we can extend their framework by offering valuable additional managerial and policy recommendations.

To analyze the set-up of a net broker for the ports industry we apply the framework by Manring and Moore (2006), through action research. Action research is appropriate given that the authors are involved in a project as action researchers in the 4-year-period



**Table 1**  
Reports of meetings.

| PORTOPIA                            | # of Reports of Meetings | Average # of pages | Average # of words | Average # of participants | Average # of participating stakeholder organizations |
|-------------------------------------|--------------------------|--------------------|--------------------|---------------------------|--|
| Internal Bilateral/<br>Multilateral | 52                       | 5                  | 1143               | 6                         | 3  |
| Internal Consortium                 | 13                       | 9                  | 2093               | 16                        | 10   |
| External                            | 31                       | 5                  | 1189               | 7                         | 4  |
| Total                               | 96                       | 7                  | 1475               | 10                        | 6  |

Source: Authors

between 2013 and 2017, and thus well positioned to identify similarities and/or novelties when developing an interorganizational network (ION) for sustainability on an industry level. The authors were involved in management and coordination of the project, providing a unique central role in the development of the set-up of the net broker function, and observation of stakeholder dynamics during the project. The action research cycle consists of four integrated steps of reflection, planning, action, observation (Wild River, 2005). The cycle for the project at hand can be described as such:

- **Reflection:** Out of the PPRISM project, the conclusion was that there is indeed a need for performance management in the ports industry, but that a separate knowledge management system should be developed which can connect the stakeholders with their information (PPRISM, 2012);
- **Planning:** The European Commission has drafted a call for an R&D project through the Seventh Framework (EU, 2013) to initiate the process “Towards a competitive and resource efficient port transport system”;
- **Action:** The PORTOPIA consortium, under the coordination and management of the authors, led the process towards implementation of a net broker function in the European ports industry.
- **Observation:** Through involvement of the researchers in the project, the different aspects of the Manring and Moore (2006) framework were translated in the set up of the net broker function to the case at hand. Given the specificity (complexity and distrust) of the industry, the set up and the role of the net broker requires additional understanding of the issues related to industry level sustainable development.

‘Reflection’ and ‘planning’ steps had been finalized before the official start date of the project, i.e. September 2013. From the first kick-off meeting onwards, over a four-year term, action research cycle steps ‘action’ and ‘observation’ altered each other in the analysis process. The collaborative project PORTOPIA<sup>1</sup> focuses on the foundation of a sustainable business model for the European (and potentially global) port industry, with as focus joint triple-bottom line performance management. It was clear from the start of the project that a net broker function was key. Once the framework for the role of the net broker was set up based on Manring and Moore (2006), towards the end date of the project, an in-depth analysis (as a final observation step in the action research cycle) was carried out for all the formal meeting reports. Action research can be used to unravel social difficulties in collaboration (Schruijer, 2006). During the project, specific dynamics in the collaboration between industry stakeholders unraveled (e.g. the role of trust). We proved this through the in-depth reading of the reports. During the final observation step of the research cycle, a total of 96 meeting

reports, emanating from project-related discussions, were analyzed (Table 1). These reports were not analyzed with software for content analysis given that the action research cycle was applied. The content of the reports thus are validation for the translation of the framework of Manring and Moore (2006) to the case study. The meeting reports contain only the discussions between either: (i) consortium members (internal bilateral/multilateral meetings or consortium), (ii) between consortium members and external stakeholders (external). This pool excludes the dissemination events where one-directional information was exchanged regarding the project. In other words, to consider the development of the net broker function only those events where discussions between, and with, stakeholders have taken place regarding the developments and implementation of the project PORTOPIA would be relevant, and dissemination events are thus excluded.

The reports of meetings were produced by three persons to have a formal record of the discussion held and the decisions taken. Furthermore, the reports were sent to the participating stakeholders within 10 calendar days following the meeting. The meeting reports were then either updated through proposed changes by participants of that meeting, or either accepted. If no objection with respect to the accuracy of the writing was sent to the project manager within 15 calendar days, the reports were considered as accepted by all stakeholders. Because of the involvement in the project, the action researchers could also grasp dynamics found in the informal meetings between several stakeholders of the project. These included conversations in the context of conferences, face to face conversations, telephone calls during the project's execution, and e-mail conversations.

The case context is particularly interesting, given the presence of for-profit organizations, hybrid organizations, governments and trade associations as key stakeholders within the collaboration (see Table 2). The action research method is appropriate given that the initiative is aimed at creating changes in the industry, with the authors being practitioners (as part of a mixed academic/industry consortium) and researchers at the same time (Susman and Evered, 1978; Eden and Huxham, 1996). This set-up is instrumental to unveil the specific stakeholder dynamics over time.

#### 4Case description: the PORTOPIA-project

Building further on the PPRISM project, the project ‘Ports Observatory for Performance Indicator Analysis’ (PORTOPIA) develops relevant indicators in six distinctive performance dimensions: market trends and structure indicators, socio-economic indicators, environmental and safety indicators, logistics chain and operational indicators, governance indicators and a user satisfaction perspective. The project is co-financed by the European Commission through the Seventh Framework Programme’s (FP7) call FP7-TRANSPORT-2013-MOVE-1: SST.2013.6–2.: “Towards a competitive and resource efficient port transport system” (EU, 2013). The FP7 program provides co-financed budgets for collaborative

<sup>1</sup> <http://www.portopia.eu>.

**Table 2**  
Characteristics of the ION case studies on sustainability collaboration.

|  | North Carolina wet textile processing industry  | EU ports industry   |
|--|---|---|
| <i>Geographical dimension</i>                                    | State-level   | Continent-level   |
| <i>Focal stakeholder</i>   | Textile industry  | Ports industry: port authorities (functional geographical delimitation of the port managing body/port authority).   |
| - Nature   | - Private companies   | - Private, Public or Hybrid organizations   |
| <i>Stakeholders</i>  | United States Environmental Protection Agency (USEPA; federal-level)<br>North Carolina Division of Water Quality (NCDWQ; state-level)<br>Publicly Owned Treatment Zones (POTZs; local level)<br>Public<br>Textile industry<br>Textile industry supply chain | European Commission (transnational)<br><br>EU Member states (country level)<br>Regional governments (regionals or provinces)<br>Local government (cities and municipalities)<br>Public<br>Port managing bodies (private/public/hybrid)<br>Other port industry supply chain stakeholders (private/public/hybrid) |
| <i>Stakeholder claim towards ION for sustainable development</i> | Favorable, mutual concerns are clear for the stakeholders.  | Unfavorable, distrust acts as a barrier to collaboration (although most stakeholders possess individual sustainability strategies)  |
| <i>Initiator of the ION</i>                                      | Top-down: POTWs had to produce an action plan in order to avoid fines issued by NCDWQ for high levels of toxicity in wastewaters.   | Bottom up: Seventh Framework Programme project PORTOPIA, led by a 12-partner consortium consisting of universities, research institutions and industrial partners with a proven track record. Long history of failed regulatory attempts by the European Commission as a competent authority.                   |
| <i>Risk for not collaborating</i>                                | Penalties and fines would be levied against the POTW if full cooperation was not obtained from every stakeholder involved.  | Opportunity costs of performance management on port-level.<br>Unwanted and/or ineffective regulation.   |
| <i>Envisaged return for collaborating</i>                        | - Number of potential savings to the POTW and the industries by avoiding POTW construction.<br>- Solution to the aquatic toxicity problem.  | - Port-level: Improved resource efficiency, improved knowledge and improved stakeholder management.<br>- Industry-level: improved sustainable development and license to operate.   |
| <i>Initial purpose of the ION</i>                                | - Ad hoc ION (which resulted in a sustainable ION).<br>- Single issue: lower levels of toxicity in wastewaters.<br>- To avoid fines issued by relevant authority (NCDWQ, state-level institution).  | - Sustainable ION<br>- Complex: improve the performance of the EU ports industry on 6 dimensions.<br>- To solidify the license-to-operate to policy makers and other stakeholders (EU, 2012).   |

Source: Authors.

projects that enhance the European Union's competitiveness. The consortium exists of 12 partners, i.e. ESPO, research institutions with a track record of industry expertise and a technology developer. Thus, the project encompasses a more holistic approach for industry performance management than the three sustainability dimensions, based on inputs in the form of data from different stakeholders of the port industry such as, amongst others, port authorities but also terminal operators, tugowners, pilots, etc. The indicators and dashboards will be available to the users in a service cloud technological environment. The service cloud consists of an open-source, innovative online knowledge management tool, where a port authority can upload, manage and analyze its own data on a port-level, and consult aggregate figures on a range- or industry-level. The goal is to establish collaboration with the industry, through a new organization (or, alternatively, incorporated inside an existing corporation) that offers a knowledge management system for port performance. In terms of the framework of Manring and Moore (2006), this organization would need to become the net broker of the European seaports industry.

In Table 2 we provide the fundamental differences between original case study of Manring and Moore (2006) and the case of the port industry to provide the basis for exploring new insights and knowledge with regards to the role of the net broker in ION for sustainability. Our case also involves an intense collaborative effort between industry and academia, which offers an extra dimension to the stakeholder complexity. Also, knowledge institutions are increasingly considering the subject of sustainability and how they can offer their knowledge to the practical side of sustainable development (Beringer, 2007; Filho, 2006; Manring, 2014; Rappaport, 2007).

## 5. Results and findings

In this section, we apply Manring and Moore's framework (2006) and specifically focus on the development and foundation of the net broker function in the industry. This function is necessary to allow the ION to work towards sustainable development (Manring and Moore, 2006). We also reflect on the other dimensions of Manring and Moore's framework considering our case by stating in Annex I: Table 3 the two last steps of the action research cycle which add to the understanding of the framework application to the case of the European ports industry how it was intended (action), and what the result of the application was (observation). The observations are supported when appropriate by representative quotes from stakeholders. We discuss as one key dimension to the aspect of the European ports industry as a virtual learning organization to demonstrate how we applied the framework, i.e. 'building a shared vision', and how Annex I should be read. After that, we discuss in depth the need for the net broker in transitioning the ports industry to sustainable development.

### 5.1. Building a shared vision in the European port industry to transition it towards a virtual learning organization

Based on Manring and Moore's framework we needed to clarify the potential shared value. This was incorporated in the initial approach to contact potential partners for the ION.

The approach to contact the potential partners was clarified in one of the first consortium meetings in 2013, and focused on the necessity to build a shared vision:

Quote 8: “The goal of this first approach is to develop one-on-one relationships with the ports, without even going too much into detail of our data needs, and keep the data collection limited. More importantly, we need to be able to get a clear view on what PORTOPIA could represent for them in terms of added value.”

Although shared value seemed to progress within the first project year, as the first discussion on the development of an industry sustainability report led a port authorities' representative to state:

Quote 9: “If we could deliver a framework, and regulate ourselves in a way that we have agreed upon ourselves, then we can show to the European Commission we do not need more regulation because we already have own regulation.”

This view was shared among the workshop participants (23 port authority representatives).

For the development of socio-economic indicators, the port authorities highlighted that each stakeholder had a different approach and thus aggregation would be complex. A shared agreement came forth that a proxy based approach would be useful. In this meeting, the port authorities already highlighted that the business model under which the net broker would function would bring large consequences to the membership of the ION.

In the *ex ante* situation of the ports industry, the mistrust between the stakeholders blocked any initial step to industry-level collaboration for sustainable development. Building the foundation that could support the systemic perspective for the port industry was a cumbersome task which is carried out, *ex durante* (during the project years) by PORTOPIA. This would enable to initiate the process towards a shared vision, so that a net broker could carry on the development of sustainability initiatives beyond the project years.

This reflects very much the process of the consultations through the technical committees of the trade organization and add to Barnett's (2009) conclusions that for the representation of certain industry members, maybe a different organization than the trade organization is preferable. Also, we must acknowledge that it seems that the more 'vulnerable' ports are more inclined to join the ION, to help each other in improving resource efficiency and improving sustainable development.

During a stakeholder meeting in March 2015, a representative of a fully corporatized port that has considerable resources claimed that:

Quote 10: “We must not forget that we do not want [PORTOPIA] to produce industry-level aggregated performance data, as it is the wish of the [European] Commission to obtain such information for regulation purposes”.

In that same meeting, a port with contrasting governance characteristics, i.e. smaller and less resourceful, and non-corporatized, countered the argument:

Quote 11: “If we do not enter this new phase, small and medium ports will never enjoy this added value. It is up to the consortium to convince the industry to be part of the community and have it start acting like a family.”

Yet, the process of installing trust between the relevant parties was proven to be cumbersome.

## 5.2. The need for a net broker in a sustainable development network

Heavy stakeholder opposition to the regulation of the seaports industry by the European Commission resulted in an industry-wide developed distrust, vis-à-vis the Commission on the one hand, and between port authorities on the other hand, as opinions on regulatory intervention differed between individual ports (who sometimes performed parallel lobbying). Thus, to install a culture of collaborative learning and work towards a shared vision of enhanced port industry performance and efficiency, the European Commission had provided funds for the startup of a net broker. Given that the project PORTOPIA essentially aimed to do so, but that the project initiated through the Seventh Framework Programme, co-funded largely by the European Commission, gave the consortium a similar disadvantage of distrust. As discussed in the second section the functions of the net broker are, as identified by Manning and Moore (2006):

- *Initiation and preparation of the network*: In the seaport industry, the preliminary attempts from the EC to form a common bond had been unsuccessful. Even when the Port Regulation got approved, distrust was still apparent, as following Quote from a representative of the trade association regarding information sharing between the consortium and the European Commission suggests:

Quote 15: “The Description of Work [of PORTOPIA] does furthermore not stipulate that the EC should get access, but that aggregated, anonymous information can be shared. It is not because the port regulation discussions have ended that we are now suddenly in a culture of trust”.

The industry trade association also would not seem ideal as they represent the port authorities interest vis-à-vis the EC with regards to policy. Moreover, Barnett's research (2009) confirms that trade associations can in some cases over represent their larger members' claims, whereas we observe that these port authorities tend to be more active with regards to sustainability initiatives already. So, for the industry to share information and work collaboratively towards performance enhancing initiatives a new net broker should be instituted. The consortium of PORTOPIA thus wanted to create a structure that can initiate, and further enhance the network for sustainability. Initially, the process of consensus was sought through the technical committee meetings of the trade association (the European Seaports Organization). Because of the reasons highlighted by Barnett (2009), and the diversity of stakeholders' interests within these committees (based mainly on the diverse governance structures), this approach was unsuccessful. Although a net broker's function is precisely to commence the building of mutual trust through the setup of the network, a net broker can be faced by the managerial challenge of diversity between the stakeholder groups of an ION, and even within a single stakeholder group. However, the intentions of PORTOPIA were unclear at the start of the project, with ports believing PORTOPIA to be a mechanism for the EC to gather data for policy making, putting the ports in a more vulnerable position. The value proposed by the net broker must thus also be clarified to the ION members, before it can act as a trust bridge, or promote mutual trust. Then, we propose that the initiation of the network is better achieved through the involvement of (in the beginning) the “coalition of the willing” whom see the shared value (i.e. those members of the network that believe in the value of collaboration). This is a fundamental task of the net broker in a case where stakeholder complexity and distrust is apparent, as can be observed in Quote 11. Furthermore, the

involvement of the trade association and reaching to other networks such as IAPH/PIANC in the function of the net broker allowed to include the diverse stakeholders of the industry:

Quote 16: “That is why we have ESPO as a member of the consortium, and why we approach the industry via the technical committees of ESPO: to address the whole community instead of only a few members.”

Also, the involvement of the IAPH PIANC Working Groups 150 and 147<sup>2</sup> have allowed to use an existing collaborative platform as a basis towards the development of a standardized Port Industry Sustainability Report. This already relates to the thought of “holographic thinking” (Senge, 1990): where if an industry can start to collaborate, even with a more limited number of network members, the image of the value will at least start to become more tangible (leading to more involvement in terms of number of members), whereas otherwise you may never get out of the situation where the numerous number of separate pieces remain a different point of view instead of being added up.

- *Maintaining and improving network collaboration:* The project consortium took initially the task of net broker for the setup of the ION, aiming to transfer this role to either a new organization after the project, or incorporating within an existing organization (the next section discusses the different scenarios). Both bilateral and multilateral negotiations were facilitated by the consortium, which focused on work towards definitions, standardized practices and new partnerships (e.g. with the IAPH/PIANC Working Groups, or the Irish Maritime Development Office). Because the industry is characterized by stakeholders whom differ in governance characteristics, and the history of difficult negotiations with regards to regulation, that distrust complexes any initiative for collaboration. It is precisely because of that, that a group of willing stakeholders whom can see the potential shared value was necessary to start the collaboration with. Thus, trust can be installed: because the risk associated with the necessary trust for collaboration is smaller when potential shared value in collaboration is clearer. If potential shared value is not observed by a stakeholder, the downside of the collaboration is bigger, thus the risk to be harmed grows larger. Trust means that a stakeholder is willing to be vulnerable in the relation, as they believe that the other party will perform an action that will benefit them, even without the ability to control or monitor (Mayer, Davis and Schoorman, 2014). Those who are vulnerable are the ones that have most to benefit of someone else. And let it be trust, as a vital key to successful collaboration in networks (Blumberg et al., 2012).
- *Promoting the partnership concept:* Once the project started, at regular times industry consultations were organized on an at least bi-annual basis. Throughout the annual ESPO Conference, PORTOPIA was present to demonstrate the project's efforts, progress and novelties. Furthermore, three European Port Performance Conferences (EPPC; September 2014, March 2016 and October 2017) were organized. The second EPPC, which generated a participation of 58 industry experts from universities, port authorities, research institutes and the trade association ESPO, specifically focused on the development of the first Port

Industry Sustainability Report, adjacent to the Working Group meetings of IAPH/PIANC.

- *Monitoring and continuously improving network performance:* Given the specific goal of PORTOPIA to set up a performance management tool, once successful through the involvement of industry stakeholders that collaborate, monitoring of not only the performance dimensions inherent to sustainability, i.e. economic, social and environmental, but others as well, will become possible. For the economic dimension, the industry was already sharing data publicly on (quarterly) traffic via static tables. This dimension was further elaborated by the development of an online application where more high-level data analysis was possible (slice-and-dice technology). The socio-economic dimension was faced with serious data availability issues, which consequently led PORTOPIA to develop a proxy-based model which can offer estimates to the ports on direct employment and direct added value for the maritime cluster (further research for the non-maritime cluster is necessary). The environmental dimension built further on the ECOPORTS initiative, which, also due to data availability and methodology congruence, led to the development of alternative insights. For example, the development of an industry-level CO<sub>2</sub> footprint indicator appeared difficult:

Quote 17: “ESPO technical committee consultation will unlikely deliver one final solution. Thinking of alternative ways is therefore needed cfr. Modal Split (let the port indicate through check boxes what is included in their figure) or a GRI approach: define a toolkit for CO<sub>2</sub> calculation or different approaches instead of one way. To come up with a way to aggregate CO<sub>2</sub> figures can provide value for stakeholders: what is the CO<sub>2</sub> footprint of the European ports industry?”

- *Responding to opportunities:* The consortium identified both the needs of the various stakeholders within the ports industry as well as the resources of those members. Thus, it is in an ideal position to “link” the needs of certain members to the resources of others. For example, the EC needed to obtain a view on the investments of European seaports to distribute the Connecting Europe Facility's (CEF) funds. Given the online portal of PORTOPIA, and the efforts of the trade association urging its members to collaborate with that study, such linkage was made possible even though the trust between EC and port authorities was still far from mutual. Another example is the opportunity to develop indicators based on data of external data suppliers e.g. Marine Traffic. However, here the issues with regards to the complexity of stakeholders (business model) and trust appear again as these external stakeholders will want to sell their data sets for high prices, which would undermine the sustainability of the business model of the ION every time a new data set would be necessary:

Quote 18: “External suppliers of data come with a high price, so establishing partnerships can provide value, but is difficult to do without paying the price attached.”

Quote 19: “... as for example for terminal operators (TOs) we were not keen to develop productivity indicators as TOs are private organizations, and because there already exist studies on this such as the JOC Productivity Report. Thus, we approached the JOC to ask for data, but they asked a very high price (out of the budget for the project). We will develop relationships with TOs for safety and security. First, trust needs to be developed by showing the added value for TOs.”

<sup>2</sup> These Working Groups specifically focus on the establishment of sustainability reporting for ports. The Working Groups are organized through the collaboration between the International Association of Ports and Harbours (IAPH) and The World Association for Waterborne Transport Infrastructure (PIANC).



## 6. Discussion: the role of the net broker and implications for a business model

During the project duration, the PORTOPIA consortium engaged in the ION as the net broker. Because the project aims to move the industry to a ION for sustainability beyond the project years, a solution needed to found to choose a new organization that continued the role of the net broker. An alternative scenario is that the function is transferred to an existing organization. First general characteristics were agreed between the consortium in December 2014, and a small group of port representatives (Steering Committee):

Quote 20: “The organization that continues the work of PORTOPIA needs to be based on a neutral, not-for-profit community model ... Ports are engaged as co-partners so they can decide on revenue/cost structure and work plan for the organization”.

One of the aspects that was key to the discussion is whom can be a customer for the intelligence developed within the ION for sustainability. This has direct implications for the revenue/cost structure of the net broker. Concretely, three types of organizations could take up the role of the net broker in the ION of the EU ports industry:

1. The European Commission;
2. A new organization;
3. The industry trade association (ESPO).

### 6.1. The European Commission as the net broker

Working towards a more resource efficient and sustainable ports industry would not be successful if membership for the ION were compulsory through regulation (obliged top-down from the European Commission) given the distrust from port authorities vis-à-vis the European Commission. In the complex environment of the port industry, the large variety of stakeholders and the history of failed regulation attempts on market access and transparency of accounts by the competent supranational authority, the European Commission (EC), has created a situation of distrust between stakeholders.

In such a context, establishing industry-level collaboration is difficult, and the framework for collaboration must be defined with care, as the following Quote 21 from a member of the EC suggests:

Quote 21: “If the [European] Commission were to finance the platform [PORTOPIA], the ports membership would remain zero”.

### 6.2. A new organization as the net broker

The establishment of a new organization to carry through the function of the net broker was discussed extensively with the port authorities. General guidelines on having an organization that should be neutral, and not-for-profit were observed to be in agreement with what the industry stakeholders preferred.

In this organization, the factor trust needed to be installed, where in the industry the only mutual trust that seems to exist is between the port authorities and the trade association. Through the

incorporation of ESPO as a majority stake in the board of the non-profit-organization (NPO), it was proposed to achieve a trusting relationship. However, because the initial technology provider, who is a for-profit organization, also needs to be related to the new NPO, discussions on this scenario failed to reach an outcome due to perceived differences between the trade association (and its members) and the private for-profit technology partners on the pricing of the services provided and the related Return On Investment parameters of the future organization.

### 6.3. Trade association as the net broker

If the net broker function then falls under the trade associations' structure, ESPO will need to consider remodeling its business model. The current business model of ESPO is based on a fixed fee per Member State (MS), which is then divided over the port authorities of that MS. However, the structure of the online platform of the ION for sustainability would imply a fee per user or per port:

Quote 22: “The system's memory is occupied per user. Hence, if more users access the system, the cost of running the system will increase. However, should the community decide that a fee per port is more appropriate, the model can be changed.”

Furthermore, Barnett (2009) proposes that under a trade association's functioning smaller members can be under disadvantage as more powerful members tend to overtake the discussions and consequently position of the trade association vis-à-vis external stakeholders such as policy makers.

Incorporating the net broker activity under the existing structure of ESPO would enlarge the activity scope of the trade association to providing intelligence on industry performance management, a task which would imply the need for considerable additional resources (to be reflected in membership fees). Certain outputs such as performance reports, recommendations to increase the sustainability of the members or industry at large, etc. could on the other hand generate additional revenue for the trade association. Should such commercial activities be carried out, these might also have a need to alter the organization from not-for-profit to for-profit, which would considerably change the nature of the trade association. Because ESPO wants to remain the policy lobby organization strictly under a not-for-profit structure, it has agreed to take on the role of the net broker but merely to develop services that can benefit the industry's competitiveness and sustainability but not for individual port authorities.

Quote 23: “ESPO has agreed to incorporate the modules of RES+ [economic], Environment and Governance in its organization for the remainder of the project and beyond.”

These modules of industry performance management relate to two of the three sustainability dimensions. Note that these dimensions already fell to a large extent under the core activities of ESPO before PORTOPIA commenced.

## 7. Conclusions

In this paper, we have contributed to the literature on inter-organizational networks (IONs) for sustainable development, trust in networks and stakeholder collaboration using a case that offers the unique context of the European ports industry. Because of the

involvement of the authors in the setup of a new ION in the European ports industry, action research could be applied to analyze the setup of a new ION for sustainable development in a unique context. We first described the framework of [Manring and Moore \(2006\)](#), and added existing literature on collaboration, trust, and sustainable development to obtain an up to date view of the characteristics of this type of ION. We then introduced the European port industry by a review on literature and practice towards sustainable development in light of the industry's specific characteristics. Consequently, we applied the framework of [Manring and Moore \(2006\)](#) to describe the formation of an ION for sustainable development it to the case of the European ports industry, and observe the transition towards an ION for sustainability and the set up and role of the net broker. This study highlighted a deepening understanding of the role of the net broker in a different case study which is characterized by complexity and high stakeholder conflict contexts.

The specific case of the EU ports industry offered unique insights in how the framework can be extended if one wants to apply it on an industry scale, and/or if an atmosphere of distrust is apparent. Distrust can act as a barrier to collaboration, as it is the expectancy of being harmed by a partner in the exchange of resources. The issue of distrust of the port authorities became apparent in following two dimensions: (i) internal distrust: being between the port authorities, e.g. Dutch study on the unauthorized state aid to Belgian and German ports), and (ii) external: which can, in turn, be divided further into 2 subdimensions: (ii.a) between the port authorities and the European Commission, and (ii.b) between the port authorities and the scientific partners/consortium. These various distrusting relationships eliminated certain options for the set up of a new business model that would take up the function of the net broker.

A first nuance that needs to be made to the framework of [Manring and Moore \(2006\)](#) is that the role of the net broker needs to be incorporated in an organization who can act as a trust bridge. However, stakeholders can trust an organization on one aspect, but may refrain from doing so in another situation. We have observed that the exploration of three alternative scenarios resulted in the fact that although the trade association is not ideal to take on the role of the net broker, the European Commission as a supranational regulatory institution or a new separate organization led to no agreement between the industry stakeholders. A trade organization may not be ideal as a 'net broker' in industry level ION for sustainable development. The reason is twofold: (i) the trade organization can be influenced by its more powerful members, and (ii) has an operational framework where it must adhere to the consensus of all its members. The members that are smaller in terms of resources, will be less likely to push through their envisaged benefits, i.o.w. their shared value potential, from. Yet it is important to have stakeholders' views represented ([Wheeler and Sillanpää, 1998](#); [Owen et al., 2001](#); [Doms, 2010](#); [Langenus and Doms, 2015](#)). The case demonstrated that because of stakeholder complexity (for-profit versus not-for-profit) and distrust issues this scenario was the only attainable alternative. Furthermore, the case demonstrated that the trade association can take up the role but in a lighter version by only providing industry level recommendations for sustainability, without direct services for individual port authorities. Hence, collaboration in this ION for sustainability will enhance, but remain limited for the time being.

Our second point, which is more focused on the process, is regarding the practical implementation of the setup of the network by the net broker in a context of distrust. Because the more 'vulnerable' members will have more to gain from collaboration, the expectancy to gain from the collaboration given, i.o.w. to trust

the other partners is likelier to materialize and will be a more 'fertile ground' to build the network infrastructure. More powerful industry players will become relatively more vulnerable, inherently facing higher risk, so they will not trust as easily in the collaboration. Here, we found that if there were indeed a situation of distrust, or a lack of trust, a net broker would be advised to seek the 'coalition of the willing'<sup>3</sup> and leverage their common bond to promote mutual trust. Based on literature, increase the membership base, the ideas of the spiral of trust ([Franke, 1999](#)) and holographic thinking ([Senge, 1990](#); [Manring and Moore, 2006](#)) can become mechanisms for extending the membership base and strengthening the links between the members. Ultimately, the sustainable development network can start to act as a virtual learning organization, where systems thinking allows to surpass individual member's goals and work towards a shared vision. The case of the EU ports industry and PORTOPIA however demonstrates that in a situation of high stakeholder complexity and high conflict, these mechanisms might not be able to commence. The value for the net broker itself must also be communicated clearly to the ION, as members will not be able to trust the net broker should they fear being harmed through the partnership. Yet, in a situation of high stakeholder complexity, value for one stakeholder does not mean shared value for the ION. The case specifically brought more understanding in a context of industry-level sustainable development through collaboration, but where the strategic stakeholders distrusted one another. Thus, we also added to the literature on conflicts and the related public-private interests issues in the ports industry.

Our limitations are that we have focused a single case. However, given the extreme nature of this case, we believe it has helped to fulfill the purpose of our research, i.e. investigating the set up of a net broker and its role in a case where high stakeholder complexity and distrust exist. This is important as the outcomes of collaboration can consist of outputs that demonstrate the meaningfulness of the industry, in terms of sustainability dimensions, towards a variety of stakeholders. Furthermore, the employment of action research entailed that we also incorporated knowledge from non-written information such as direct conversations, telephone conversations, communications through e-mail, etc. on relevant aspects. Although this type of information does not allow for reproduction, it is vital to include in the purpose and added value of the research.

We believe that further case-based research could provide more insights in the subtleties of ION formation for sustainable development. Also, better understanding of the dynamics of trust will be vital for the more managerial recommendations of which initiatives can enhance trust inside an ION, which ones can be undertaken by for example a net broker and in what phase. We propose that in the beginning, more initiatives will need to be taken by the net broker, but which ones are more likely to succeed the purpose of mutual trust building? And which ones are not so successful? Also, the idea of being more inclined to trust when you are vulnerable would be worthwhile to be analyzed more in-depth.

## ANNEX 1

<sup>3</sup> Note that this is a different concept than what [Kofman and Senge \(1993\)](#) and [Manring and Moore \(2006\)](#) describe as the 'community of commitment', which refers to the ION eager to develop solutions to sustainable industrial development issues.

**Table 3**

Synoptic overview of the application of the framework for ION for sustainable development on the case of the European ports industry

| <i>The European ports industry as an ION for sustainable development</i>  |   |  |
|---|---|--|
|   | Action  | Observation  |
| <i>Unifying purpose</i>   | The purpose of the project PORTOPIA is to "facilitate consensus building on the next steps that need to be made in realizing the objectives of a sustainable and efficient EU port system", with action that should "ensure the active participation of the key stakeholders" (EC, 2013). To bring the key stakeholders together for collaboration in an ION, we have learnt, as described in previous paragraphs, that value propositions will move the independent members towards collaboration. It is the task of the net broker, in this case the project PORTOPIA, to link the stakeholders' resources and value propositions.  | It is the task of the net broker, in this case the project PORTOPIA, to link the stakeholders' resources and value propositions. In the case, the members of the ION conveyed that there was indeed a pressure from stakeholders to pursue sustainable development, as one participant during a workshop stated, in line with findings from Woolridge (1999), Darbra et al. (2005) and identified by ESPO, 2012:<br><i>Quote 1: "There is indeed a need to start thinking about producing a sustainability report for ports. In fact, there is a market driven demand for it, as shippers want to tell their customers that their products are transported along a green supply chain."</i><br>The role of ESPO appeared to be central to act as a 'trust bridge' between the stakeholders of the project.   |
| <i>Independent members</i>  | Given the mistrusting relationship regarding the sharing of information between industry stakeholders, independence of members is a strong condition for any network to be able to be formed. The benefit from being a part of the network needed to become more tangible to set up the collaboration. For that, the role of the net broker comes in and is crucial, as well as the factor of trust: to build trust, the net broker had to assure independence of the members in the ION.   | As from the first consultation (Rome, 2013) with the ports industry, the set up of the online data platform needed to ensure that independence for members remained guaranteed through the development of aggregated data and industry information on sustainability. The IT developer explained specifically that:<br><i>Quote 2: "Multitenancy is a reference to the mode of operation of software where multiple independent instances of one or multiple applications operate in a shared environment. The instances (tenants) are logically isolated, but physically integrated. In PORTOPIA, the tenants (application instances) will be representations of organizations. This means that the data confidentiality is assured in a information architecture where each stakeholder has its own private instance of the system"</i>  |
| <i>Voluntary links</i>  | Given the commercial sensitivity of some data it is crucial that the potential partners whom would share such data remain free to share certain data or not. As the network comprises stakeholders whom are in direct or indirect competition with each other, this is a fundamental aspect to have support and to let trust grow between the ION members.  | In the second industry consultation, the consortium agreed that they needed to:<br><i>Quote 3: "Present the project as a menu for the ports: if they want they can give data on certain perspectives of their choice (or for all perspectives, ideally), and if they don't want to provide data in a particular perspective they don't have to. It is not an all-or-nothing exercise."</i>   |
| <i>Multiple leaders</i>   | As every stakeholder of the industry holds a piece of the puzzle for industry-level performance management, each stakeholder adds to the resilience of the network.   | The inclusion of industry stakeholders, academic researchers and an IT provider were all necessary. The industry players have primary data on performance, academic researchers whom have expertise and knowledge on the development of harmonized indicator development and the inclusion of an IT developer that can develop a platform where the data and methodology come together and can be provided in a user-friendly way to industry stakeholders.  |
| <i>Integrated levels</i>  | Even within one stakeholder group contrasting characteristics exist. For example, port authorities can be either private, public or hybrid organizations (Verhoeven, 2009). Consequently, the goals and strategic priorities of the port authority will be diverse. Although the individual goals can be conflicting to some extent, shared value and trusting relationships should be developed to set up the ties between the stakeholders to form the network. We find validation for the finding of Manring and Moore (2006) that if stakeholders are unaware of each other's concerns (given the geographical spread and differences on institutional and governance dimensions [Verhoeven, 2009; ESPO, 2016]) or if insufficient trust between them exists, links are more difficultly forged. Therefore, a crucial step was to go from an approach of contacting representative committees of 20–30 port authorities to working directly with a group of stakeholders who were convinced of the shared value creating potential.   | Once the output was being produced for ports to use in their performance management, it was decided that in order to gain momentum the approach needed to shift to working with a coalition of willing stakeholders, as following Quote from a consortium meeting (May 2015) reflects:<br><i>Quote 4: "There is a need to work with a small/pilot group of friendly ports who are willing to work intensively with the technology provider and the consortium."</i>  |
| <i>The European ports industry operating as a Virtual Web Virtualness</i> | Because of the integration of not only the port authorities in the ION, but also other members of the port community, such as, terminal operators, shipping lines, etc. a holistic view of industry performance improvement can be attained. Although the port authorities are the managing bodies of the port clusters, they need to convince the companies that use their infrastructure and services (e.g. the tenants, shipping lines, manufacturing firms) of the need for measures and sometimes even relocation to other parts of the port area. However, ports do not have direct regulatory impact on these customers, and such requests affect the relationships with these companies, potentially negatively influencing ports' competitive position (e.g. through the renegotiation of long-term lease or concession contracts with tenants). Hence, while port management can design a strategy, the actual decision highly depends on the interaction with government authorities and a whole range of stakeholders (Kolk and van der Veen, 2002). Thus, by incorporating these stakeholders into the ION, knowledge regarding efficient solutions for sustainability can be shared. Moreover, it would offer a platform for the definition of industry level performance standards, which can then be formulated in agreement with the | The inclusion of all stakeholders in the ION was proposed through the inclusion of trade associations of ports users, such as the European Maritime Pilots Association (EMPA), European Tugowner's Association (ETA), etc. However, to include these formally from the start of the ION would make the process more complex, as a whole other issue of data sensitivity would arise and they would need consensus from their members.<br><i>Quote 5: "There have been discussions with other stakeholders on the data they have. For example EMPA has no data on its members, while ETA has a database on their fleet. The members of these organizations also need to agree to share their data with the consortium."</i><br>Also, not all trade associations would have been able to provide added value to the ION, which could have endangered potential partnerships with port authorities whom are the focal stakeholders: |

(continued on next page)

Table 3 (continued)

| The European ports industry as an ION for sustainable development |   |  |
|---|---|--|
|   | Action  | Observation  |
|   | industry stakeholders. For this industry, a strong degree of “virtualness” (Venkatraman and Henderson, 1996) is thus necessary, as the ports industry is indeed characterized by multiple stakeholders, whose involvement is needed to adhere to the complex sustainable development issues.  |  |
| Multiplexing  | The ION of PORTOPIA will allow the individual ports to “multiplex”, in other words to communicate different messages over a single line. Precisely because of the holistic approach through several performance dimensions, ports can better explain their performance towards a variety of stakeholders. E.g. suppose that the CO <sub>2</sub> footprint of a port increases, generally considered a “bad” thing. However, if we consider that the traffic volume has risen over the same period, and that although CO <sub>2</sub> has risen as well, because of efficiency gains the rise was relatively low, the holistic view justifies the at first sight negative evolution of environmental performance.  | It appears that certain ‘cross-perspective’ indicators, e.g. a link between governance models with economic and environmental indicators on performance are quite sensitive for the industry stakeholders. Negative messages such as certain types of port authorities performing worse on the environmental dimension is something that they would want to avoid.<br>A separate work package focused specifically on the development of a balanced view on performance of a port. However, this seemed very difficult to obtain because of the different policy domains which would require the inclusion of a larger number of stakeholders, further increasing complexity.  |
| Spiral of Trust   | Through the involvement of different stakeholders in the discussions surrounding sustainability development for the ports industry, the network can grasp the different, sometimes even contrasting views and incorporate them into the outputs. The links between the stakeholders are, in line with Manring and Moore's (2006) thought, expected to strengthen as communication increases and trust strengthens. Once this process starts, the “spiral of trust” (Franke, 1999) develops and solidifies the partnerships within the network. However, we find that before such evolution can start, we believe more in-depth knowledge is required for the cases of those networks where the initial atmosphere is not favorable for partnerships. This nuance will be further discussed in the section of the net broker's characteristics.  | Within the first year of the project the issue of trust already became clear, as following meeting consultation with the industry states:<br><i>Quote 6: “For the project to be successful we need good collaboration and input with and from ports. We need to build trust between the ports and PORTOPIA: internal newsletter, communication around data confidentiality (confidentiality agreement).”</i><br>The issue of trust even translated through the consortium, where differences in characteristics of organization (profit versus not-for-profit) disturbed collaboration with regards to handling commercially sensitive data:<br><i>Quote 7: “Trust should exist between partners, yet it was decided to have a formal document on confidentiality.”</i>  |
| The European ports industry as a virtual learning organization    |   |  |
| Building a shared vision  | Clarification of the potential shared value was incorporated in the initial approach to contact potential partners for the ION.<br>In the <i>ex ante</i> situation of the ports industry, the mistrust between the stakeholders blocked any initial step to industry-level collaboration for sustainable development. Building the foundation that could support the systemic perspective for the port industry was a cumbersome task which is carried out, <i>ex durante</i> (during the project years) by PORTOPIA. This would enable to initiate the process towards a shared vision, so that a net broker could carry on the development of sustainability initiatives beyond the project years.<br>This reflects very much the process of the consultations through the technical committees of the trade organization and add to Barnett's (2009) conclusions that for the representation of certain industry members, maybe a different organization than the trade organization is preferable. Also, we must acknowledge that it seems that the more ‘vulnerable’ ports are more inclined to join the ION, to help each other in improving resource efficiency and improving sustainable development. | The approach to contact the potential partners was clarified in one of the first consortium meetings in 2013, and focused on the necessity to build a shared vision:<br><i>Quote 8: “The goal of this first approach is to develop one-on-one relationships with the ports, without even going too much into detail of our data needs, and keep the data collection limited. More importantly, we need to be able to get a clear view on what PORTOPIA could represent for them in terms of added value.”</i><br>Although shared value seemed to progress within the first project year, as the first discussion on the development of an industry sustainability report led a port authorities' representative to state:<br><i>Quote 9: “If we could deliver a framework, and regulate ourselves in a way that we have agreed upon ourselves, then we can show to the European Commission we do not need more regulation because we already have own regulation.”</i><br>This view was shared among the workshop participants (23 port authority representatives).<br>For the development of socio-economic indicators, the port authorities highlighted that each stakeholder had a different approach and thus aggregation would be complex. A shared agreement came forth that a proxy based approach would be useful. In this meeting, the port authorities already highlighted that the business model under which the net broker would function would bring large consequences to the membership of the ION.<br>Furthermore, during a stakeholder meeting in March 2015, a representative of a fully corporatized port that has considerable resources claimed that:<br><i>Quote 10: “We must not forget that we do not want [PORTOPIA] to produce industry-level aggregated performance data, as it is the wish of the [European] Commission to obtain such information for regulation purposes”.</i><br>In that same meeting, a port with contrasting governance characteristics, i.e. smaller and less resourceful, and non-corporatized, countered the argument:<br><i>Quote 11: “If we do not enter this new phase, small and medium ports will never enjoy this added value. It is up to the consortium to convince the industry to be part of the community and have it start acting like a family.”</i><br>Yet, the process of installing trust between the relevant parties was proven to be cumbersome.<br>The ability to work further on sustainable development was an incentive for ports to join in the ION, the conclusions from a meeting between the consortium and UK ports representatives highlight:<br><i>Quote 12: “PPRISM's environmental data input was a good motivation for UK ports to engage in the project. Health and Safety indicators might be an</i> |
| Personal mastery  | To work towards the vision of sustainable development in the ports industry, PORTOPIA proposed to gather all the necessary data and information from individual members and aggregate them to range- or European levels. In that way, individual members can better assess and manage their own progress considering the range or industry average. Moreover, by sharing the best practices anonymously, each member  |  |



Table 3 (continued)

| The European ports industry as an ION for sustainable development |  |   |
|---|--|---|
|   | Action   | Observation   |
| Surfacing and testing mental models                               | could gather new knowledge, without jeopardizing commercial sensitivity.<br>In the development of the First Industry Sustainability Report 2016 drafted by PORTOPIA, provides access to all (not only who can afford it) industry members to commence the process of sustainability reporting. The case proved that there must be a “community of commitment” (Kofman and Senge, 1993; Manring and Moore, 2006) to have an effective sustainable development network. In the initial phase, the consortium sought a coalition of the willing, stakeholders whom believed in the shared value potential of PORTOPIA.  | <i>incentive for UK ports to participate in PORTOPIA. PORTOPIA can be very positive as UK ports are mostly interested in their own performance.”</i><br><br>However, even the consortium faced hurdles of opposition, which could be back related to the work of Barnett (2009) given that the trade association as a key partner in the collaboration, needed to:<br><i>Quote 13: “Follow with the consensus of all of our members [port authorities]. We cannot take the lead with only the ones that want to take the lead”.</i><br>The voice of the port authorities that saw higher risk in the ION was thus reflected in the cumbersome process, and a different approach was necessary to initiate the progress of an ION. |
| Team learning   | For the network to start learning as a team, according to the framework of Manring and Moore (2006), the individual member organizations should think, in a systemic way, in terms of what is best for the whole versus what is best for the individual organization.  | The previously stated Quote Q11 is also very relevant in this aspect. In a stakeholder meeting in March 2016, discussions needed to be concluded, and that the representatives of the port authorities needed to:<br><i>Quote 14: “Get rid of the ‘yes, but ...’ attitude, or we will not progress”.</i><br>This observation was shared by the trade association representative, the consortium and several port authorities.   |
| Systems thinking  | As described in the previous section this discipline relates to the thought of holographic thinking (Senge, 1990). The Quotes reflect to some extent the more extreme, but differing views within the single stakeholder group of the ports. As discussed, it is therefore vital to group the coalition of the willing, who are more inclined to trust one another, as an initial step in the collaboration. In our case, this is a step that fell under the tasks of the net broker (see also next section). Translated to the ideas of Manring and Moore (2006) and Senge (1990), the holograph will only start to become vaster if a group of ports commence to collaborate. Once the holograph becomes vaster, more ports start to ‘see’ the holograph and the shared value potential, and become more inclined to enter the ION, as the associated risk will become relatively smaller. | In order to enhance systems thinking, it was apparent that working via technical committees of the trade association did not result in efficient progress. On the contrary, because of the stakeholder complexity, goals and characteristics countered progress. Therefore, it had been decided to opt for a pilot ports group that was willing to collaborate, i.o.w. whom saw the shared value. In this process, collaboration was more efficient and the process towards sustainable development gained.   |

Source: Authors, based on the framework of Manring and Moore (2006).

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